Rock Chips

Winter 2009

Alberta Geological Survey

The Peace River Urban Geology and Landslide Project

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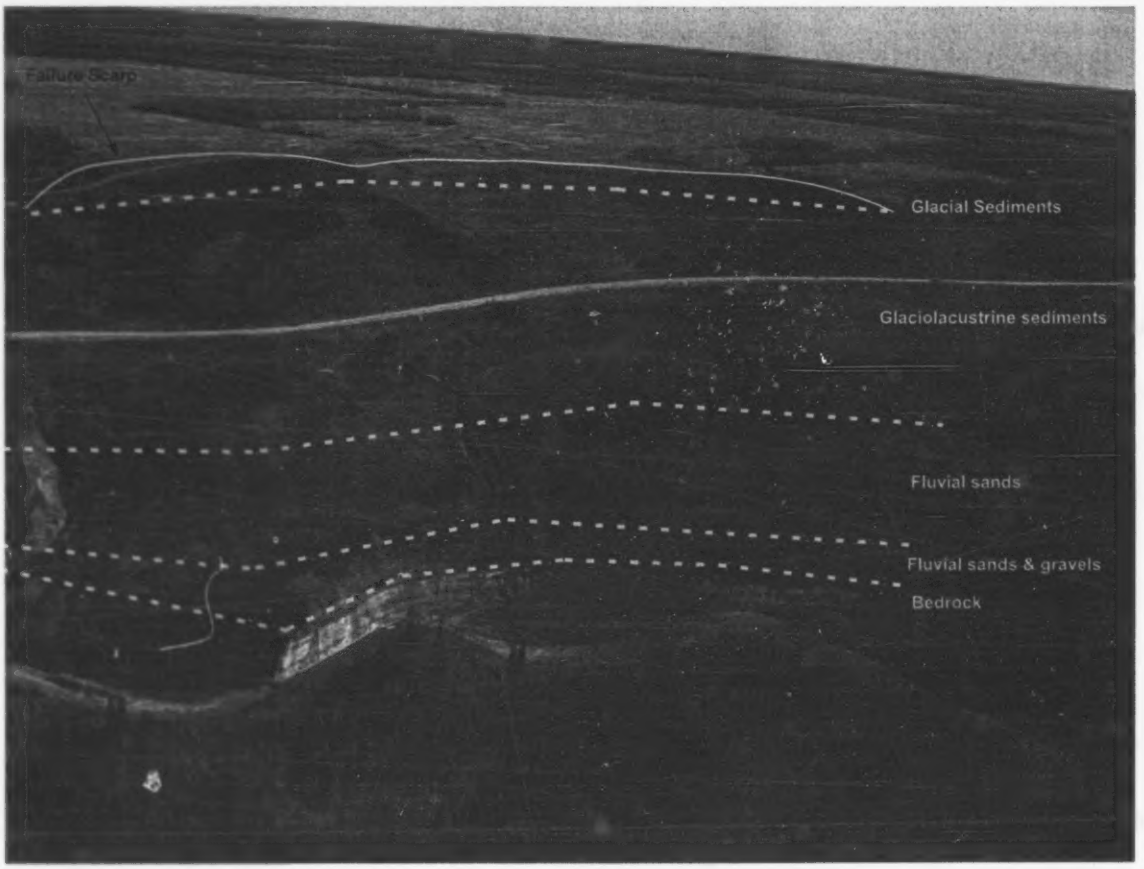
The town of Peace River has a large portion of its buildings and roadways built either on the flood plain or on the unstable valley walls of the Peace River Valley. To move goods, products or resources in and out of the town, active landslides must be crossed and the related infrastructure maintained. As there are various types and sizes of landslides that move at various rates, it is important to better understand both these landslides and the complex geological conditions that led to the formation of these features.



Aerial oblique photograph showing the locations of the various stratigraphic units as they are represented on a large landslide on Highway 2, on the eastern side of the study area.

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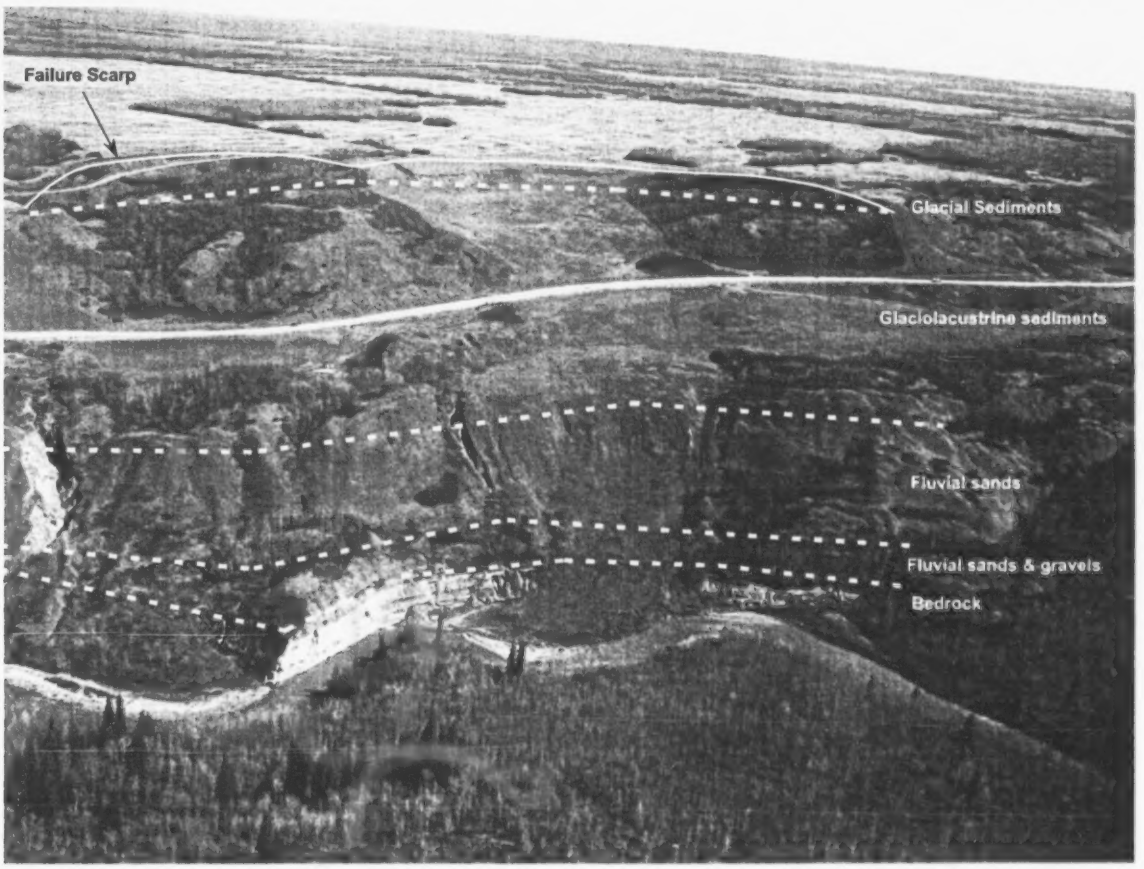

Aerial oblique photograph showing the locations of the various stratigraphic units as they are represented on a large landslide on Highway 2, on the eastern side of the study area.

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In 2006, AGS initiated a study to develop a model to better understand the extent, rate and style of the large-scale landslides in and around the municipality. This project is being conducted in partnership with the University of Alberta and Alberta Transportation and is being supported by the Town of Peace River, CN, ATCO Electric, ATCO Pipelines and the Canadian Space Agency.

The first part of the study was to develop a 3-D geological model and complete an inventory of landslides in the area. This was necessary because of the geological (glacial) nature of the drift and the various triggers that can initiate the landslides. Alberta Geological Survey and the University of Alberta will use this information to develop logical groupings for the landslide types that have occurred.

To better understand the glacial geology of the study area, more than 1400 well logs were reviewed by AGS staff and a 3-D model of the subsurface was built. Detailed field mapping of available exposures was also undertaken to aid in this process. As there were still some key gaps in the knowledge of the subsurface, AGS initiated a drilling program in the winter of 2008/2009 to gather a continuous profile of the drift column above bedrock at two locations. At each location, the upper 120 metres was continuously cored using rotosonic-drilling techniques and an adjacent hole was drilled using mud rotary drilling and logged using downhole geophysics. With these core data, supplemented with mapping of exposures in the area, we obtained a complete column of the approximately 170 metres of glacial drift overlying bedrock. Results of the drilling program are available in our Open File Report 2009-18.

Once the stratigraphy of the subsurface was better understood, the AGS team then constructed high-resolution ground models derived from airborne Light Detection and Ranging (LiDAR) to correlate common elevations of landslides around the study area and better understand the specific weak zones within the subsurface where the large landslides were occurring.

Not only are the LiDAR data extremely valuable in recognizing the common features of the large landslides that cover the study area, AGS staff members are also using GIS tools to automatically identify different landslide features in the region. In general, the older, flatter landslides are typically less active (moving at a slower rate) than steeper, more active features. By undertaking spatial analysis on the LiDAR data, and considering factors such as slope angle, surface roughness and slope curvature, the hope is that features will become apparent that will differentiate between

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Energy Resources Conservation Board
Alberta Geological Survey
#402, 4999 - 98th Avenue
Edmonton, Alberta
Canada T6B 2X3
Tel: (780) 422-1927
Fax: (780) 422-1918
E-mail: AGS-Info@ercb.ca

We are also on Facebook, Twitter, FriendFeed, YouTube and LinkedIn.

Clients in the Calgary area may view AGS publications at

Energy Resources Conservation Board
Library
640 - 5th Avenue SW
Tel: (403) 297-8242.

Story Contact Information

The following AGS staff members may be contacted for further information on their articles or citations.

The Peace River Urban Geology...
Corey Froese (780) 427-2872

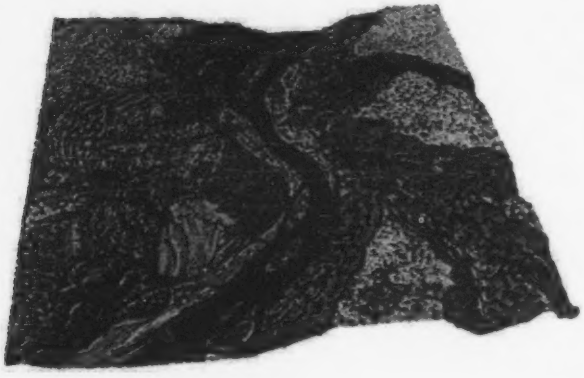
Water Sampling in the Edmonton Calgary Corridor...
Rick Huff (780) 427-2893

Metal Potential of the Mesoproterozoic Purcell...
Alexei Rukhlov (780) 427-0030

Staff may also be contacted via e-mail by entering the author's first name.last name@ercb.ca

Comments and suggestions for Rock Chips may be sent to Maryanne Protz at maryanne.protz@ercb.ca

different levels of activity. These data would then be coupled with conventional geotechnical monitoring information and other space-borne monitoring data to identify features that are moving at faster rates than other features.


0° - 5° slope / concave / gentle terrain
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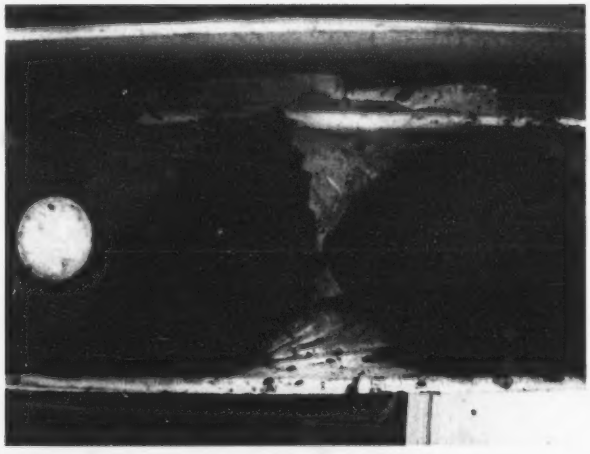
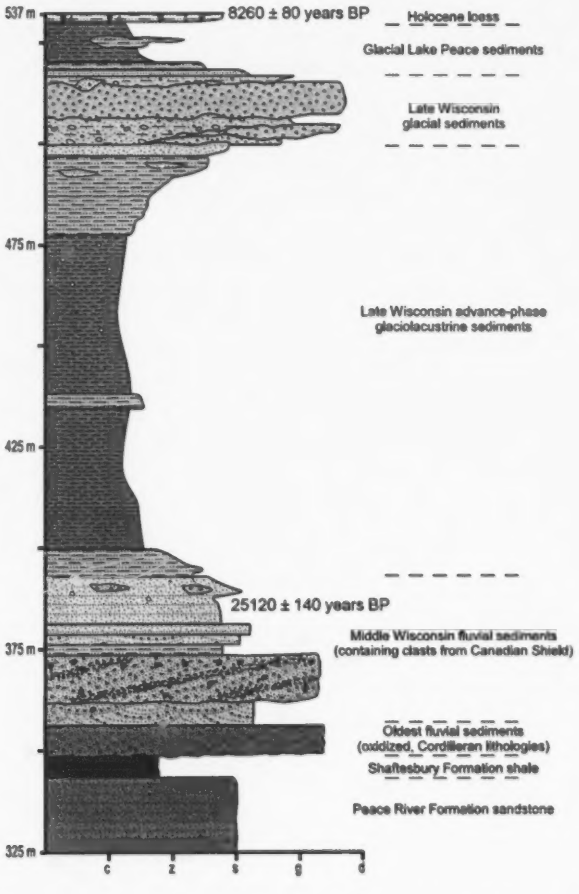
3-D image showing results of automated pattern recognition being applied to high-resolution LiDAR data to aid in identifying various rates of landslide movement at the town of Peace River.

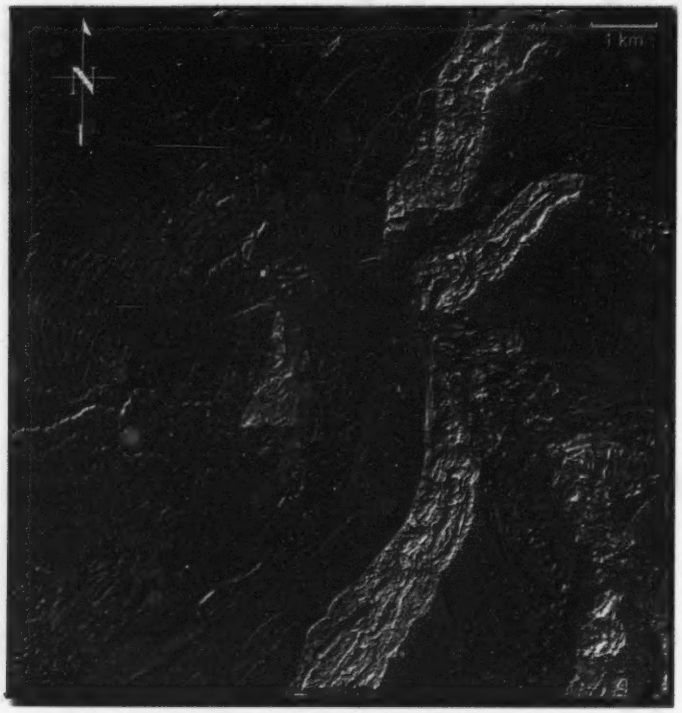


Sample of the core obtained from the rotosonic drilling program showing existing failed zones (slickensides) in the thick glacial soils.

A rotosonic-drilling rig at the Sagitawa Look Out in December 2008.

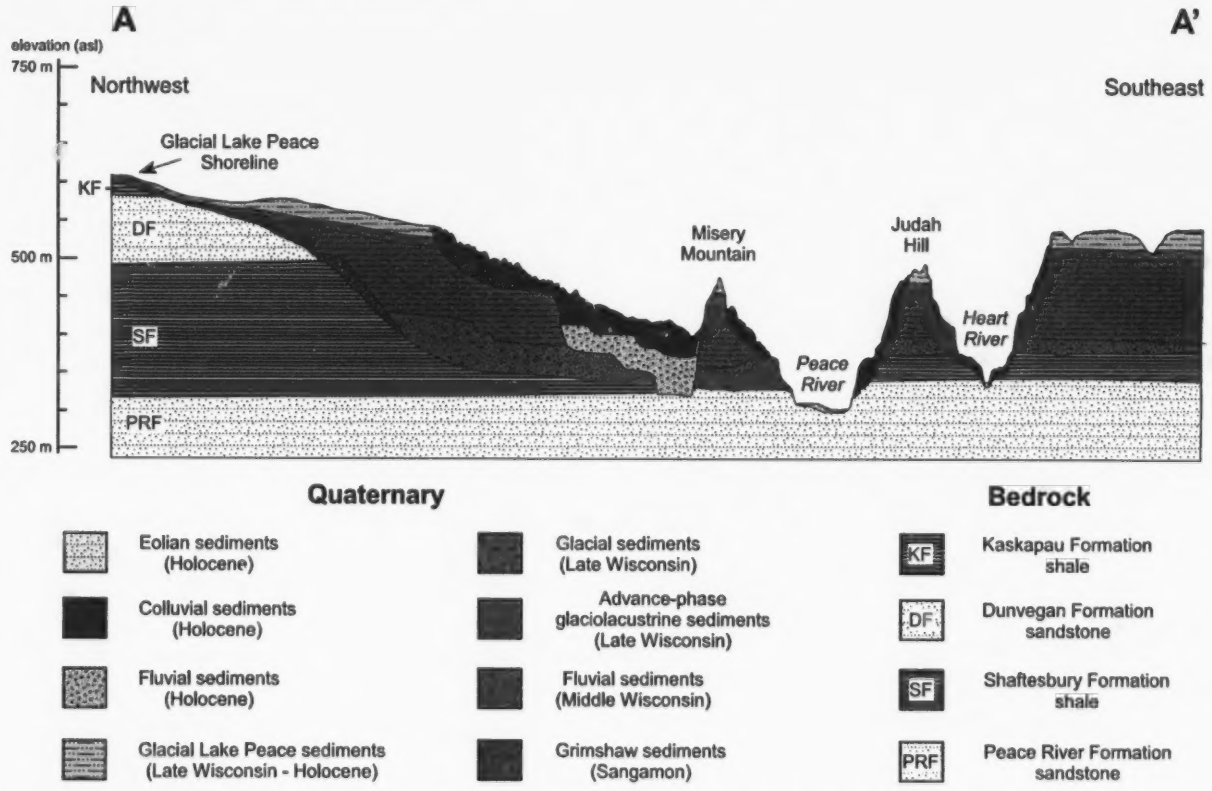


Stratigraphic column showing the glacial drift overlying the bedrock (Shaftesbury and Peace River Formations), as derived from mapping of exposures.



A sample of the bare-earth LiDAR digital elevation model that is used to map landslide features in the study area.

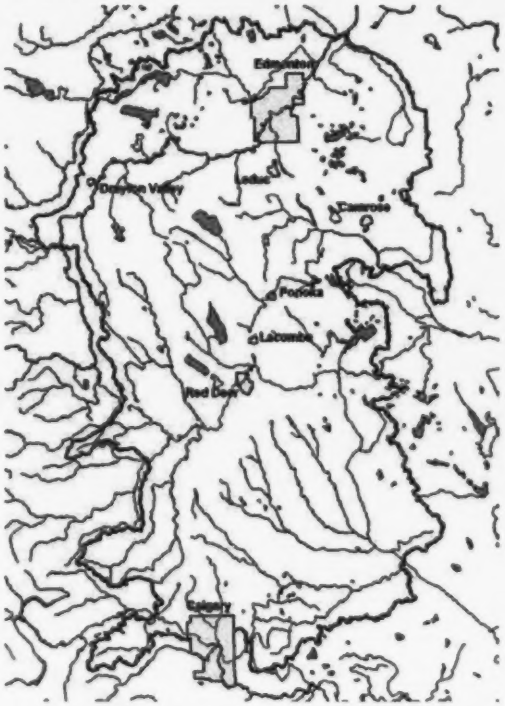
Alberta Geological Survey and the University of Alberta plan to complete the various phases of the project by the summer of 2010. Watch the AGS website for upcoming publications and news on the project. ❖



Schematic cross-section showing the cover of glacial materials and landslide debris overlying the bedrock at the town of Peace River.

Water Sampling in the Edmonton—Calgary Corridor

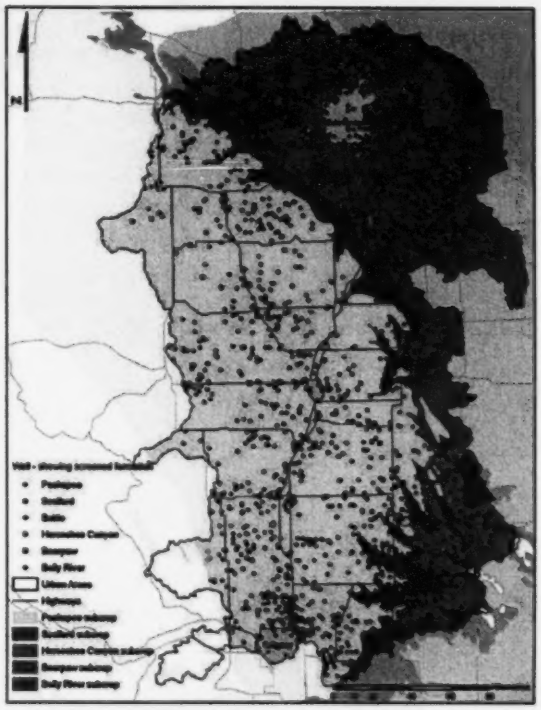
In 2008, Alberta Geological Survey (AGS) began a collaboration with Alberta Environment (AENV) to inventory saline and non-saline groundwater within the Edmonton-Calgary corridor (ECC). One of the products of this collaboration will be a series of thematic maps representing regional groundwater quality within the ECC. A second product will be an AGS report about the source areas and geochemical evolution of groundwater in the Paskapoo Formation between Edmonton and Calgary.



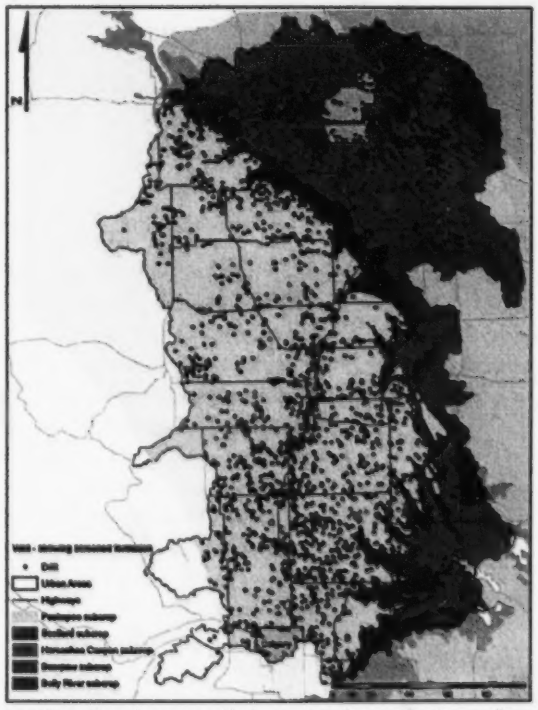
Study area of the Edmonton-Calgary corridor regional groundwater study.

More than 20 000 existing analyses of groundwater available from AENV, AGS, the Alberta Research Council and the Energy Resources Conservation Board were screened for inclusion in the regional groundwater-quality study. Screening based on the completeness and quality of the analysis and the reliability of location information associated with the sampled wells produced 10 825 usable analyses. The maps at the right show the locations of usable analyses selected for the regional study. Preparation of thematic maps showing regional water-quality information based on the analyses represented in these maps is currently underway.

Approximately 50 groundwater and springwater samples were collected during the summer of 2009 to study the

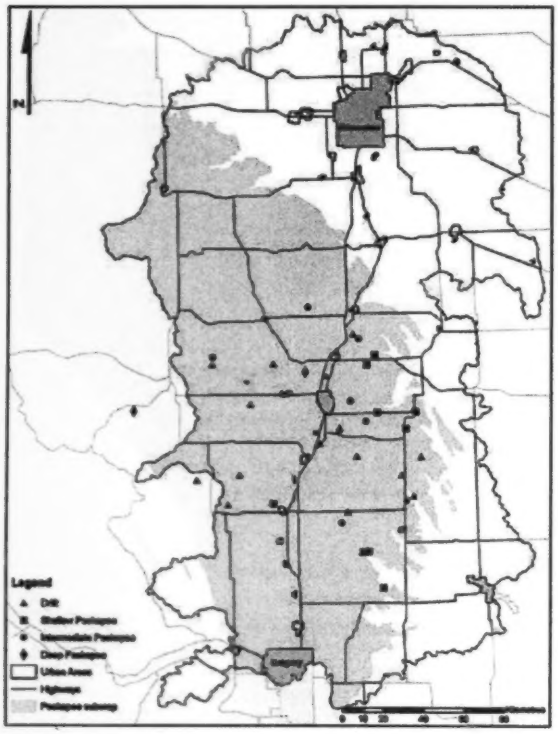


Location of analyses used in the regional groundwater-quality study by major bedrock aquifer.



Location of analyses used in the regional groundwater-quality study of the glacial drift aquifer.

source areas and geochemical evolution of groundwater in the Paskapoo Formation between Edmonton and Calgary. Groundwater was sampled from shallow (25-50 metres below land surface), intermediate (90-150 metres below land surface) and deep (greater than 150 metres below land surface) intervals within the Paskapoo Formation and from glacial drift deposits overlying the Paskapoo Formation.



Location of groundwater samples collected during the summer of 2009.

Sampled wells ranged from state-of-the-art, public supply wells, such as the one owned and operated by the Village of Clive, to a well constructed by a landowner near Olds. Sampled wells were pumped until chemical and physical characteristics of the water, including pH, temperature, electrical conductance and dissolved oxygen concentrations, reached stable values prior to sampling. Observed stability of these characteristics prior to sampling helps to ensure that sampled water is representative of groundwater quality and does not include 'left over' water that has been sitting in the well bore.

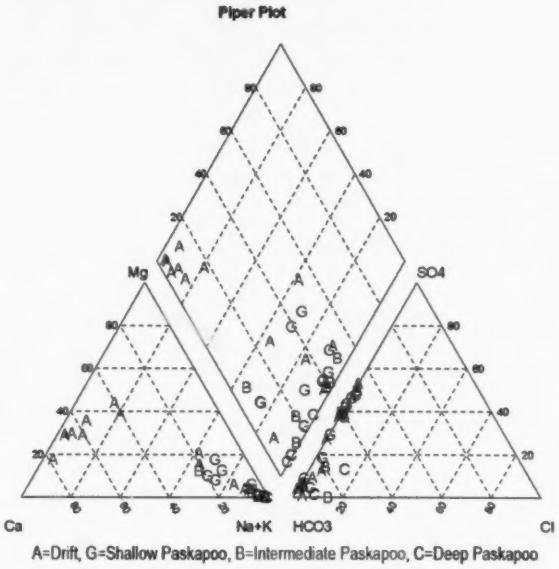
Preliminary analysis of the chemistry of groundwater samples collected in the summer of 2009 shows that water from all depths in the Paskapoo contains sodium (Na) as the dominant cation and most contain

Public supply well owned and operated by the Village of Clive.

Well constructed by a landowner near Olds.

Summer student Landon Woods monitoring for stability of water characteristics during sampling of a well.

bicarbonate (HCO_3) as the dominant anion. The data further suggest that sodium becomes increasingly dominant with increasing depth in the Paskapoo.



Piper plot showing analyses of groundwater collected from shallow, intermediate and deep intervals within the Paskapoo Formation and from glacial drift deposits overlying the Paskapoo Formation.

Extension of data points from the two lower triangular plots onto the upper diamond-shaped plot shows a group of seven samples that stand apart from the rest. These samples, collected from glacial drift sediments, contain a greater portion of calcium (Ca) and magnesium (Mg) than the other drift samples and are all located within the western part of the sampled area. The greater calcium and magnesium content may be associated with differences in the mineralogy of drift sediments between the western and eastern parts of the sampled area, which are, in turn, caused by differences in the sources of the glacially transported drift sediments. Analysis of hydrogen, oxygen, carbon and strontium isotopes in groundwater may show other systematic differences in groundwater chemistry that can be used to understand the sources and geochemical evolution of groundwater in the study area. By understanding the geochemical evolution of groundwater we can better understand the current state of water systems, and provide the inputs for models to simulate and predict future changes in the groundwater chemistry. These predictions can then help decision makers develop water management plans. As we continue our work in the ECC, we will publish the results on a regular basis to provide updates on our progress. The first of these updates will be available in early 2010. ❖

Recently Released Publications

Digital Datasets

DIG 2004-0034 Alberta Sand and Gravel Deposits with Aggregate Potential.

DIG 2009-0070 Sand and Gravel Site Investigations, McLennan Area, Alberta (NTS 83N/NE).

Maps

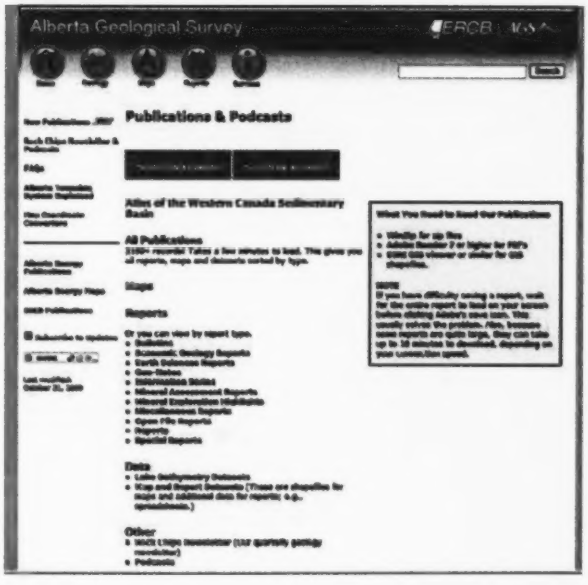
MAP 536 Sand and Gravel Deposits with Aggregate Potential McLennan, Alberta (NTS 83N/NE). 3.81 MB PDF.

Open File Reports

OFR 2009-17 Preliminary Results of Sediment and Bedrock Coring in the Edmonton–Calgary Corridor, Central Alberta. 79.5 MB PDF.

OFR 2009-21 Compositions of Low-Chromium Garnet Xenocrysts from Selected Ultramafic Bodies in the Northern Alberta Kimberlite Province. 8.08 MB PDF.

Many of our reports can be downloaded for free at
www.ags.gov.ab.ca/publications



The Career of Joseph Burr Tyrrell

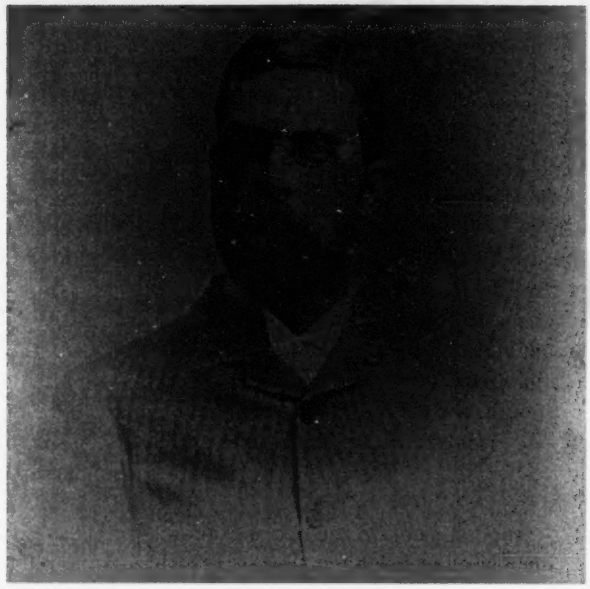
Joseph Burr Tyrrell was born in 1858 in Weston, Ontario. He attended Upper Canada College and intended to become a lawyer before a health scare forced him to change career paths. On the advice of his physician, he chose a career that would allow him to work in the outdoors. He began his geological career after graduation in 1881 with the Geological Survey of Canada (GSC).

His first expedition was in Western Canada in 1883, led by George Dawson, to explore and map the Crowsnest Pass, the Kootenay Rivers, Kicking Horse Pass and the Alberta portion of the foothills of the Rocky Mountains. One of the mountains surveyed during that expedition now bears Tyrrell's name: Mount Tyrrell in Banff National Park.

His second expedition was perhaps his most famous. In the summer of 1884, Tyrrell and his expedition team set out to explore and map an area north of Calgary, between the Bow and Saskatchewan rivers. They surveyed an area covering approximately 116 500 km^2. In June 1884, while exploring in the Red Deer River valley, Joseph and his assistant discovered significant coal seams near the town of Drumheller. These coal deposits would prove to be some of the largest in North America. In that same month, Tyrrell made another discovery. He noticed something unusual in a valley wall. After climbing the steep slope to get a closer look, he discovered the skull of a dinosaur. As he and his team continued to explore the area, they realized that they had found more than just a single dinosaur skeleton, but what amounted to a dinosaur graveyard. That first dinosaur found was transported to Ottawa to be displayed in the National Museum of Natural Sciences. Originally identified as *Laelaps incrassatus*, it was later given the name *Albertosaurus* in the same year that Alberta was named a province: 1905.

Joseph Tyrrell led a number of additional expeditions through unexplored portions of Saskatchewan and Manitoba. During these expeditions, he travelled remarkable distances by canoe, foot, snowshoe or dogsled. These expeditions led to the improvement of Canada's maps, and they provided valuable information on the rocks that would eventually be mined in the Thompson and Flin Flon areas of Manitoba.

In 1898, Tyrrell resigned from the GSC and left for the Yukon in search of gold, working in Dawson City as a mining consultant. After the boom was over, he moved to Toronto and established a geological consulting practice.



Joseph Tyrrell. Photo courtesy of Geological Society of Canada.

Over the course of his life, this explorer-geologist-cartographer-consultant discovered many things and was honoured in a number of ways. In 1896, he received the Back Award from the Royal Geographical Society of England. He received the Murchison Medal from the Geological Society of London in 1918. In 1930, he received an honorary degree of Doctor of Laws from the University of Toronto. He was awarded the Flavelle Gold Medal from the Royal Society of Canada in 1933. In 1947, he received the Geological Society of London's Wollaston Medal. For his work supporting the mining industry in Canada, he was inducted into the Canadian Mining Hall of Fame in 1997.

Joseph Tyrrell died in August 1957, just shy of his 99th birthday. The Royal Tyrrell Museum, opened in 1985 in Drumheller, Alberta, continues his paleontology work and honours him and his 1884 discovery of *Albertosaurus* in the Red Deer River valley. ❖

Metal Potential of the Mesoproterozoic Purcell Supergroup and Mafic Intrusions in Southwestern Alberta

Completing the series of Rock Chips articles on metal potential of igneous rocks in southern and southwestern Alberta, this review focuses on the Mesoproterozoic igneous and sedimentary rocks of the Purcell Supergroup. This rock package consists of more than an 11 km thickness of accumulated clastic, carbonate and volcanic rocks intruded by gabbroic sills and dykes, exposed in the Purcell and Rocky Mountains in southeastern British Columbia and southwestern Alberta. It also has more than 20 km of correlative strata in western Montana, Idaho and eastern Washington, where it is known as the Belt Supergroup. The rocks of the Mesoproterozoic (1500 – 1320 million years before present [Ma]) Belt-Purcell Supergroup consist of marine turbidites deposited in the intracontinental rift grabens in the west and stratigraphically equivalent shallow-water carbonates and clastic rocks of the surrounding rift platform in the east, overlain by shallow-marine and nonmarine mud flat, lagoonal, lacustrine and fluvial sediments of a rift-cover sequence.

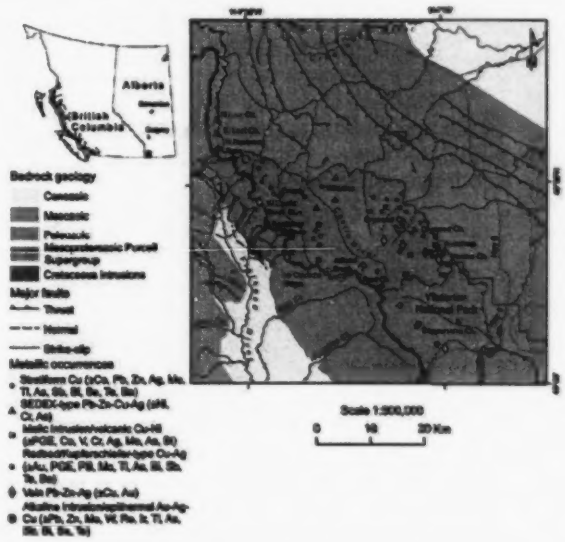
The Canadian part of the Belt-Purcell basin nonconformably overlies a 2600 – 1780 Ma crystalline basement and is unconformably overlain by either the Upper Proterozoic Windermere Supergroup (770 – 570 Ma), Lower-Middle Cambrian or Devonian strata, with the exposed portion being displaced over 100 km to the northeast along faults of the Rocky Mountain fold and thrust belt.

The following elements are abbreviated in this article: Ag, silver; As, arsenic; Au, gold; Ba, barium; Bi, bismuth; Co, cobalt; Cr, chromium; Cu, copper; Ir, iridium; Mo, molybdenum; Ni, nickel; Pb, lead; Pd, palladium; PGE, platinum-group elements; Pt, platinum; Re, Rhenium; Sb, antimony; Se, selenium; Te, tellurium; Tl, thallium; V, vanadium; W, tungsten; Zn, zinc.

The history of metal exploration and mining in the Belt-Purcell Basin dates back to the early 1860s and includes several world-class base and precious metal deposits, such as the

- Wild Horse Creek placer Au in British Columbia;
- North Star, Sullivan and St. Eugene Pb-Zn-Ag-Au mines in British Columbia;
- Coeur d'Alene Ag-Pb and Blackbird Cu-Co mining districts in Idaho;
- Butte Cu-Ag-Au-Mo in Montana;
- Sheep Creek Cu-Co in Montana; and
- Rock Creek, Spar Lake and Montanore Cu-Ag deposits in Montana.

Following a small-scale mining operation at Coppermine Creek within the current Waterton National Park boundary in the early 1900s, regional exploration during the 1960s and early 1970s led to the discovery of numerous Cu-Ag and Pb-Zn showings within the Purcell Supergroup exposed in the Clark Range area of southwestern Alberta.



Simplified geological map and distribution of metallic occurrences within the Purcell Supergroup in southwestern Alberta and southeastern British Columbia, NTS map areas 82G and H.

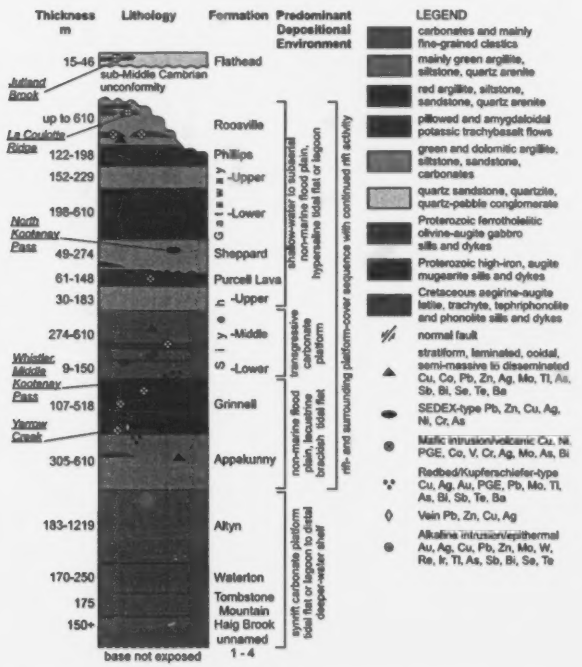
Little subsequent exploration was performed in the area. Although several distinct types of mineralization have been recognized in the Clark Range, their timing and relationships to synsedimentary rifting and magmatic activity remain poorly understood.

In an attempt to fill these knowledge gaps, Alberta Geological Survey re-visited several metallic occurrences in the field and performed geochemical analyses of igneous and sedimentary rocks of the Purcell Supergroup in southwestern Alberta during 2008 and 2009. In addition to conventional laboratory analysis of collected samples and a scintillometer survey, we

used a portable Thermo Scientific Niton® XL3t 900 XRF analyzer in the field to quickly determine metal concentrations in rock outcrops. This let us identify several new metallic occurrences. Preliminary results are discussed below; complete data will be released in an upcoming Open File Report.

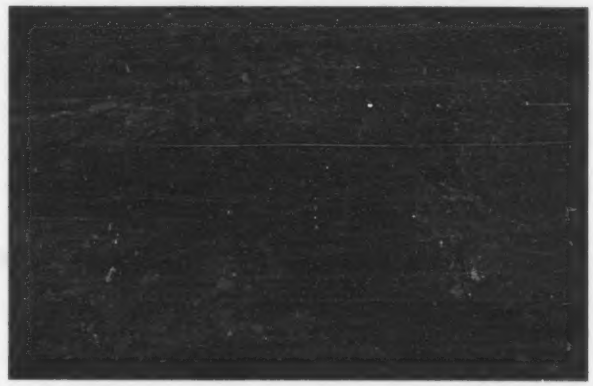
Igneous Rocks in the Clark Range Area

Compositionally diverse sills, and less commonly dykes, of distinct age groups intrude the Purcell Supergroup at different stratigraphic levels in the Clark Range area of southwestern Alberta. The youngest of these events comprises the Cretaceous Flathead intrusions composed of aegirine-augite latite, trachyte, tephriphonolite and phonolite that cut the uppermost Mesoproterozoic and overlying Middle Cambrian strata in the western part of the Clark Range. These rocks, along with the compositionally similar volcanic rocks of the Early Cretaceous Crowsnest Formation were discussed in the summer 2009 edition of Rock Chips.



Generalized stratigraphy of the Mesoproterozoic Purcell Supergroup in the Clark Range area of southwestern Alberta, showing the stratigraphic positions and some examples (underlined) of the metallic occurrences.

Precambrian igneous activity produced high iron, tholeiitic, olivine-augite gabbro and augite mugearite sills and dykes, up to 25 m thick, at several stratigraphic levels within the Purcell Supergroup. It also produced voluminous outpouring of the Purcell lava (up to approximately 150 m thick) comprising chloritized, pillowed and amygdaloidal potassic trachybasalt in the middle part of the Mesoproterozoic succession in the Clark Range area.



Mesoproterozoic ferrotholeiitic olivine-augite gabbro sill intruding interlayered buff-weathering limestone and grey siltstone of the lower Siyeh Formation, Purcell Supergroup, on the north flank of Cloudy Ridge. Note the bleaching of the limestone along either margin of the sill. Yarrow Creek valley, Clark Range, southwestern Alberta.

The sills are made of black to dark red, medium-grained to aphanitic (quenched margins) rock, dominantly composed of augite, serpentinized olivine, brown hornblende, plagioclase, iron oxides, minor alkali feldspar and quartz, accessory apatite and titanite, and chlorite, scapolite, epidote, zeolite, and calcite replacing primary minerals or infilling amygdules or secondary veins. The intrusions are similar to 'Moyie sills' intercalated with turbidites of the Aldridge Formation in southeastern British Columbia, where they make up to several hundred metres thick bodies that persist laterally for tens of kilometres, with the aggregate thickness of sills greater than 2 km. The Mesoproterozoic intrusions were emplaced at shallow depth into wet, unconsolidated sediment during intermittent magmatic events associated with the rifting and volcanism between 1470 and 1380 Ma. The geochemistry of the sills suggests magma derivation by partial melting of the mantle 30-40 km beneath the surface and similarity to modern, within-plate alkali or tholeiitic ocean-island basalts associated with mantle plumes. This might imply that Belt-Purcell rifting was an active-type rift caused by the arrival and lateral spreading of a mantle plume, as opposed to the passive-type rift due to lithospheric tension.

The interplay of Mesoproterozoic extensional faulting, igneous activity and related hydrothermal convection

during the deposition of the Purcell Supergroup resulted in the accumulation of syngenetic, seafloor and diagenetic base and precious metals in the Clark Range.

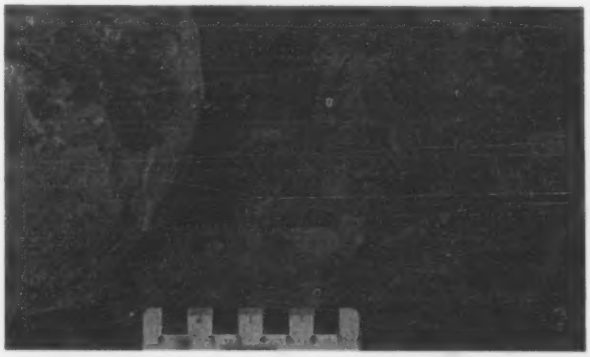
Metallic Occurrences Within the Purcell Supergroup

Several types of base- and precious-metal occurrences were identified at different stratigraphic levels within the Purcell Supergroup in the Clark Range area of southwestern Alberta. Gabbroic intrusions contain locally elevated concentrations of Cu-Ni-Co-V±PGE and other metals (e.g., Coppermine Creek, Yarrow Creek, Spionkop). At Middle Kootenay Pass, a 4.5 m thick sill within interbedded red argillites and quartzites of the Grinnell Formation yielded up to 381 g/t V, 165 g/t Cu, 5.1 g/t Ag and 1.6 ppb Pt. Another sill at West Castle River at the same stratigraphic level returned up to 490 g/t Cr, 167 g/t Ni, 64 g/t Co and 3.7 ppb Pd.

Rare chalcopyrite and bornite partially infilling vesicles up to 1 cm in diameter were observed in Purcell Lava at Drywood Creek. A single sample from this site returned 176 g/t Zn, 181 g/t Cu, 43 g/t Co and 8 ppb Ir.

At North Kootenay Pass, SEDEX-type Pb-Zn-Cu-Ag mineralization comprises a 3 m thick section of laminated grey siltstone with streaks and thin laminations of sphalerite and galena interbedded with sandstone and algal dolomites of the Sheppard Formation, approximately 15 metres above the Purcell lava. Samples returned up to 2.56% Pb, 1.4% Zn, 0.98% Cu and 79.5 g/t Ag. At Yarrow Creek, a bed of calcareous mudrock with iron-sulphide concretions in the Lower Siyeh Formation returned approximately 660 g/t Pb, 0.13% As, 104 g/t Mo with elevated Ag and Ba based on portable XRF analyzer data. Stratiform, semi-massive iron sulphide-rich to laminated, ooidal to disseminated Cu-Co and Cu-Pb-Zn (±Ag, Mo, Tl, As, Sb, Bi, Se, Te, Ba) occurrences could be a different type of syngenetic (Blackbird-type) or diagenetic base-metal mineralization. A 20 cm thick, rusty-weathering, grey, coarse-grained quartzite bed with up to 10% of less than 1 mm pyrite ooids at the contact of the Grinnell and Siyeh formations observed both at Spionkop Ridge and South Drywood Creek returned 456 g/t Cu, 34 g/t As, 20 g/t Co and 0.26 g/t Tl.

Redbed- or Kupferschiefer-type Cu-Ag showings in the Appekunny, Grinnell and Lower Siyeh formations comprise the most common types of base-metal mineralization in the Clark Range (e.g., Whistler Mountain, Spionkop, Yarrow Creek and Grizzly Creek). Coarse-grained, cross-bedded and rippled quartz-arenite cycles, with argillite pebble-conglomerate layers, are interbedded with red and green argillite and siltstone throughout the Grinnell Formation and contain copper sulphides replaced by malachite. These copper-bearing cycles were possibly produced by precipitation of oxidized copper in reducing conditions during short-lived fluvial to lacustrine episodes in a semi-arid, flood plain environment before any major compaction of the rock.



Malachite (green) replacing copper sulphides in quartz arenite and intraformational argillite pebble-conglomerate of the Grinnell Formation, Mesoproterozoic Purcell Supergroup, at Spionkop Prospect in southwestern Alberta.

At Middle Kootenay Pass, a malachite-stained, quartz arenite bed returned 1.17% Cu, 8.7 g/t Ag, 7 ppb Au, 58 g/t Mo, 33 g/t As, 22 g/t Bi, 1.7 ppb Pt and 0.1 ppm Te. Another variety of Kupferschiefer-type mineralization occurs in the lowermost Siyeh Formation at South Drywood Creek, where a 15 cm wide zone of black argillite with abundant malachite staining returned up to 0.19% Cu, 1.1 ppm Sb, 0.06 ppm Te and 1.7 ppb Pd.

Discordant Pb-Zn-Cu sulphide veins a few millimetres thick cut the upper contact of gabbro sill intruding the quartzite of the Grinnell Formation at Yarrow Creek. Alkaline intrusion-related or epithermal precious-base metal mineralization occurs in the Roosville Formation argillites along the contacts of Cretaceous Flathead intrusions, sourced from a distinct metallogenic event during the Cretaceous-Tertiary Laramide Orogeny. This was discussed in the summer 2009 edition of Rock Chips.

In conclusion, the Mesoproterozoic igneous activity coupled with syndepositional faulting in a rift basin represents an important metallogenic interval that produced concentrations of both syngenetic and diagenetic base and precious metals in southwestern Alberta. Additional studies are underway at AGS to further identify and understand the metal potential of Alberta. ❖

New Web Content for Geological Hazards

Did you ever wonder what kinds of geological hazards may exist in Alberta, and which ones the Alberta Geological Survey is studying? Are there any interesting projects going on in your backyard? In September, this information became available with the click of a mouse via our website.

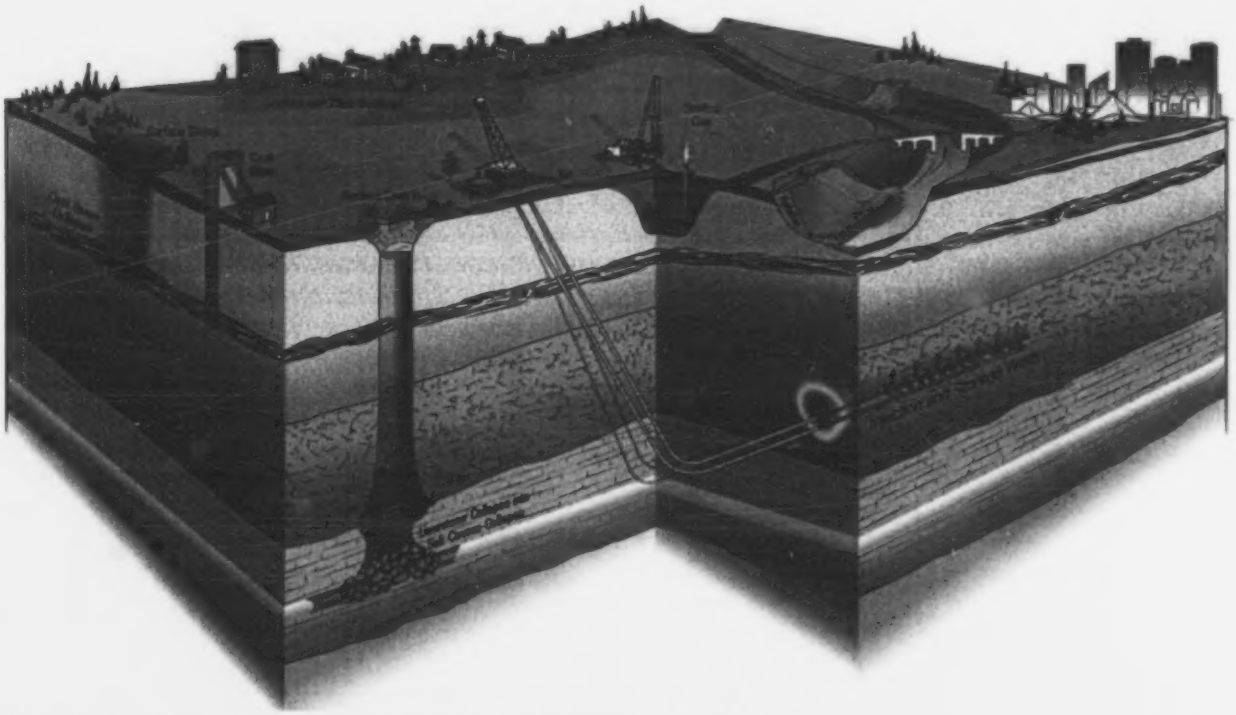
For those with a general interest who want to get more information on the types of hazards in Alberta, the main geological hazards web page gives an overview of the types of hazards our team works with: natural and human-induced. Natural geological hazards are triggered by a change in the natural environment. Human hazards are triggered by the interaction of human activity in an area with pre-existing natural conditions. For each type of hazard, the reader can get a more thorough explanation.

If interested in more specific details of the various projects that the Geological Hazards section staff is working on, there are also links to seven projects currently under way. Each project has an overview of its purpose, photos, list of collaborators and a direct link to the AGS project lead.

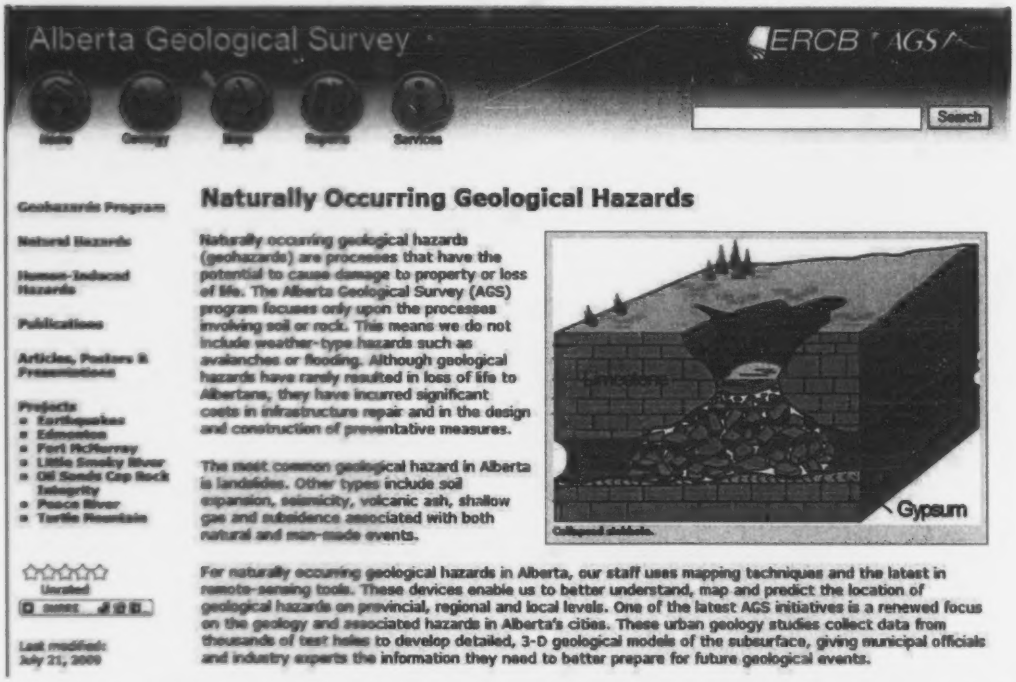
For the more technical reader, links on the side bar take the viewer to AGS publications and external articles, posters and presentations prepared by AGS staff and collaborators.

The Geohazards Program focuses exclusively on physical geological hazards. Chemical geological hazards, including natural and human-introduced contaminants, are not presently part of our program.

For both sets of geological hazards, our team of engineers, geologists and technologists describe and map geological hazards by applying the knowledge of the geological materials at the surface and in the subsurface, along with emerging remote-sensing technologies. ❖



Schematic diagram showing the various types of physical geological hazards that exist in Alberta.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Oil Sands Cap Rock Integrity
Peace River
Turtle Mountain
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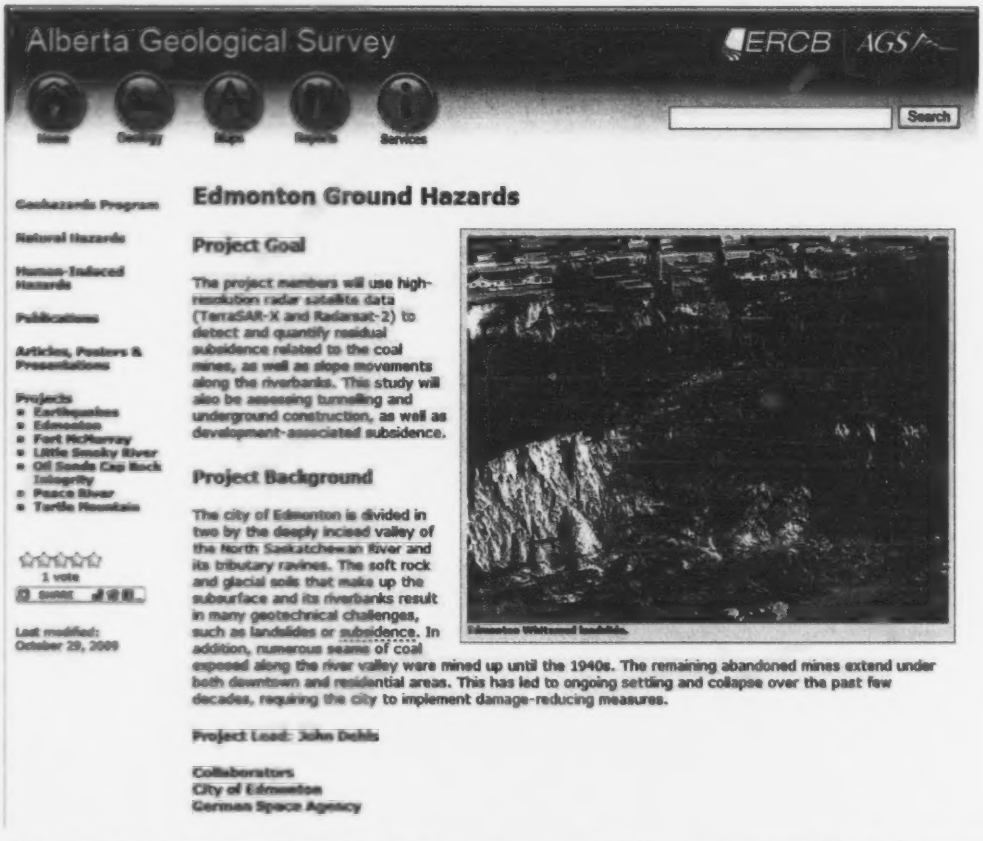
Naturally Occurring Geological Hazards
Naturally occurring geological hazards (geohazards) are processes that have the potential to cause damage to property or loss of life. The Alberta Geological Survey (AGS) program focuses only upon the processes involving soil or rock. This means we do not include weather-type hazards such as avalanches or flooding. Although geological hazards have rarely resulted in loss of life to Albertans, they have incurred significant costs in infrastructure repair and in the design and construction of preventative measures.
The most common geological hazard in Alberta is landslides. Other types include soil expansion, seismicity, volcanic ash, shallow gas and subsidence associated with both natural and man-made events.
Gypsum
For naturally occurring geological hazards in Alberta, our staff uses mapping techniques and the latest in remote-sensing tools. These devices enable us to better understand, map and predict the location of geological hazards on provincial, regional and local levels. One of the latest AGS initiatives is a renewed focus on the geology and associated hazards in Alberta's cities. These urban geology studies collect data from thousands of test holes to develop detailed, 3-D geological models of the subsurface, giving municipal officials and industry experts the information they need to better prepare for future geological events.

Overview pages provide high-level details on the broad types of geological hazards that exist in Alberta and how AGS is addressing them.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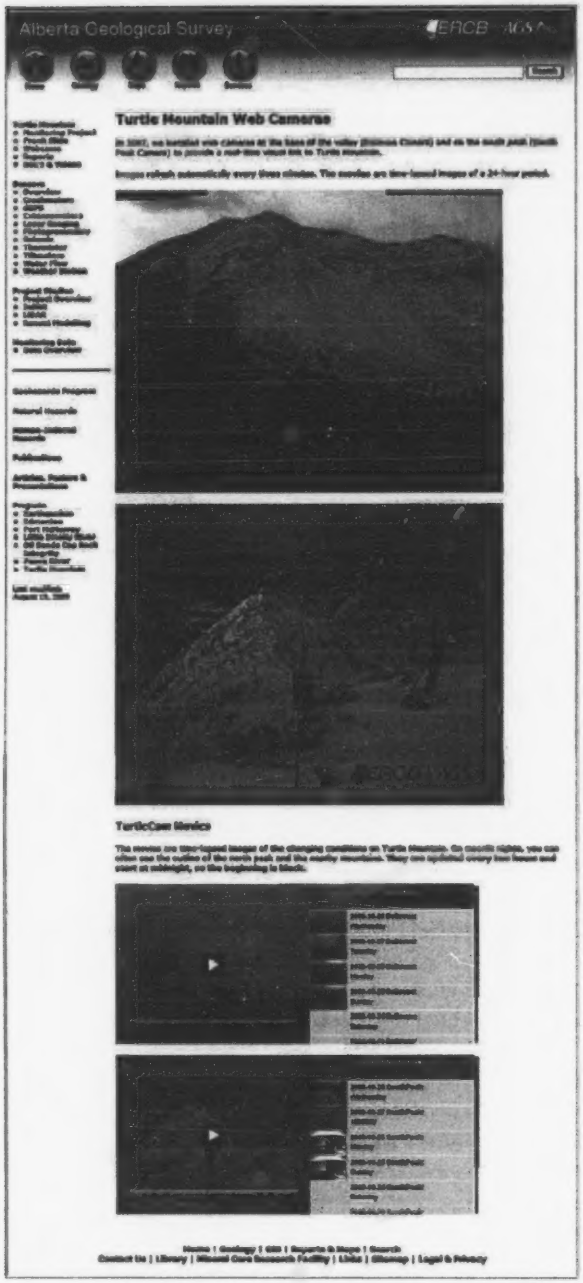
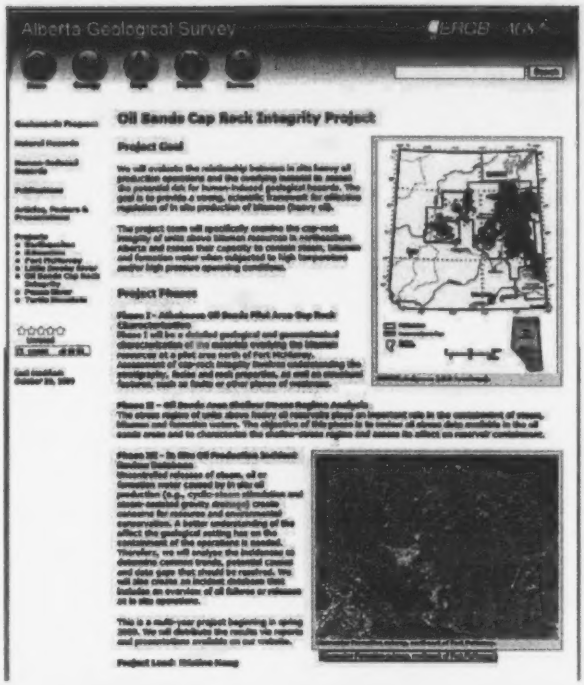
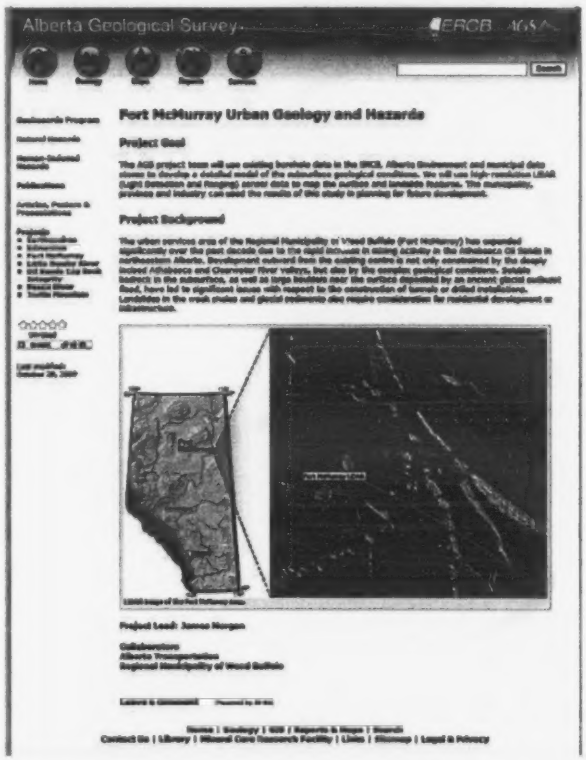
Edmonton Ground Hazards
Project Goal
The project members will use high-resolution radar satellite data (TerraSAR-X and Radarsat-2) to detect and quantify residual subsidence related to the coal mines, as well as slope movements along the riverbanks. This study will also be assessing tunnelling and underground construction, as well as development-associated subsidence.
Project Background
The city of Edmonton is divided in two by the deeply incised valley of the North Saskatchewan River and its tributary ravines. The soft rock and glacial soils that make up the subsurface and its riverbanks result in many geotechnical challenges, such as landslides or subsidence. In addition, numerous seams of coal exposed along the river valley were mined up until the 1940s. The remaining abandoned mines extend under both downtown and residential areas. This has led to ongoing settling and collapse over the past few decades, requiring the city to implement damage-reducing measures.
Project Lead: John Dehls
Collaborators
City of Edmonton
German Space Agency

Each project has its own web page providing an overview of the study. Edmonton Whitemud landslide photo courtesy of Edmonton Journal.



On the Turtle Mountain project page, use the webcam link to see regularly refreshed images of the current conditions on Turtle Mountain.



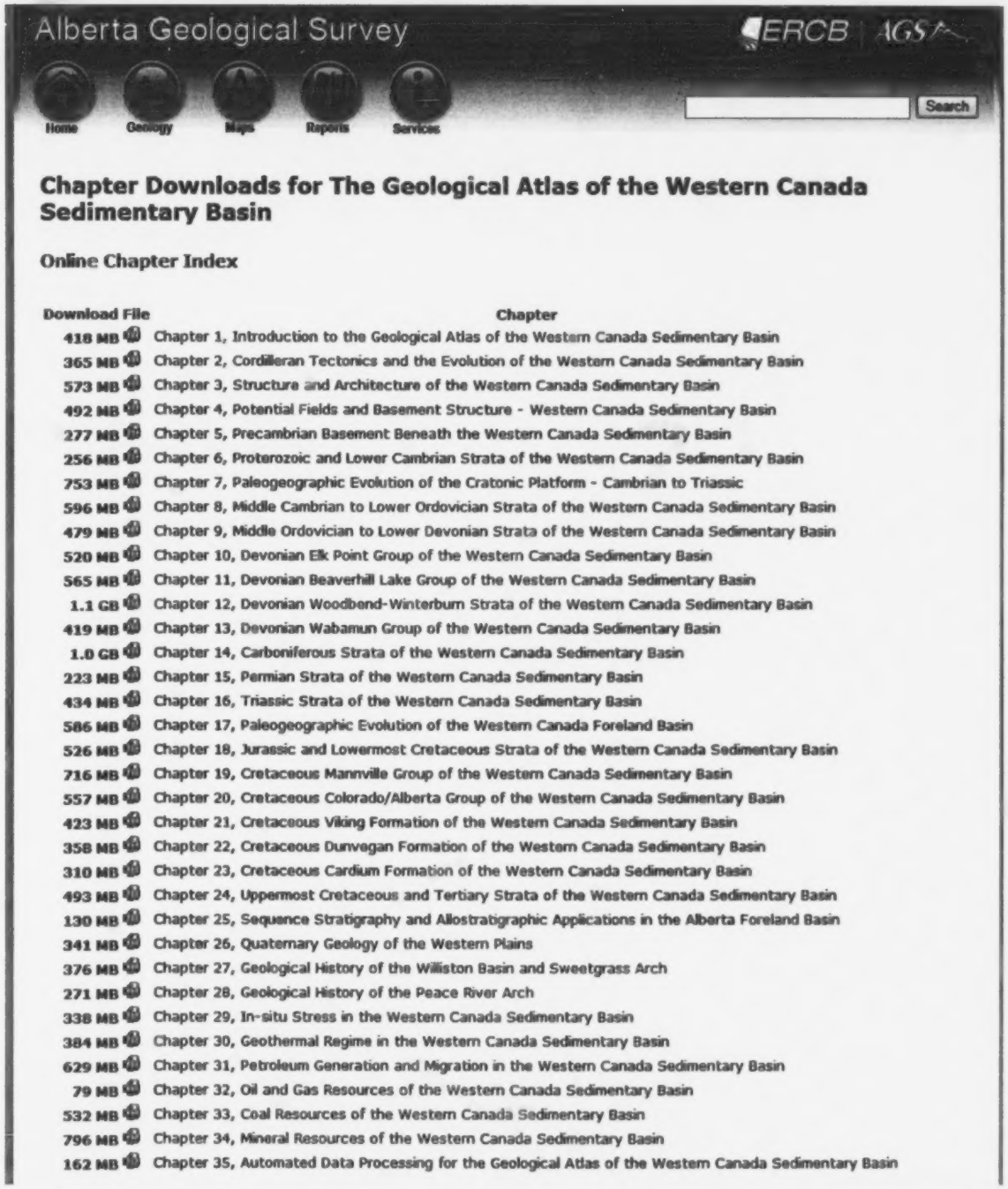


Find out what geohazard projects are going on in the Fort McMurray area on the web pages shown above.

Publications Now Available in PDF for Download

The Geological Atlas of the Western Canada Sedimentary Basin PDFs are now on our website. Each HTML chapter provides a link to a PDF version. There's also a page that lists all of the PDFs. The digital version also provides some of the underlying digital data.

http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html



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Chapter Downloads for The Geological Atlas of the Western Canada Sedimentary Basin

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Download File	Chapter
418 MB	Chapter 1, Introduction to the Geological Atlas of the Western Canada Sedimentary Basin
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573 MB	Chapter 3, Structure and Architecture of the Western Canada Sedimentary Basin
492 MB	Chapter 4, Potential Fields and Basement Structure - Western Canada Sedimentary Basin
277 MB	Chapter 5, Precambrian Basement Beneath the Western Canada Sedimentary Basin
256 MB	Chapter 6, Proterozoic and Lower Cambrian Strata of the Western Canada Sedimentary Basin
753 MB	Chapter 7, Paleogeographic Evolution of the Cratonic Platform - Cambrian to Triassic
596 MB	Chapter 8, Middle Cambrian to Lower Ordovician Strata of the Western Canada Sedimentary Basin
479 MB	Chapter 9, Middle Ordovician to Lower Devonian Strata of the Western Canada Sedimentary Basin
520 MB	Chapter 10, Devonian Elk Point Group of the Western Canada Sedimentary Basin
565 MB	Chapter 11, Devonian Beaverhill Lake Group of the Western Canada Sedimentary Basin
1.1 GB	Chapter 12, Devonian Woodbend-Winterburn Strata of the Western Canada Sedimentary Basin
419 MB	Chapter 13, Devonian Wabamun Group of the Western Canada Sedimentary Basin
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223 MB	Chapter 15, Permian Strata of the Western Canada Sedimentary Basin
434 MB	Chapter 16, Triassic Strata of the Western Canada Sedimentary Basin
586 MB	Chapter 17, Paleogeographic Evolution of the Western Canada Foreland Basin
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557 MB	Chapter 20, Cretaceous Colorado/Alberta Group of the Western Canada Sedimentary Basin
423 MB	Chapter 21, Cretaceous Viking Formation of the Western Canada Sedimentary Basin
358 MB	Chapter 22, Cretaceous Dunvegan Formation of the Western Canada Sedimentary Basin
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79 MB	Chapter 32, Oil and Gas Resources of the Western Canada Sedimentary Basin
532 MB	Chapter 33, Coal Resources of the Western Canada Sedimentary Basin
796 MB	Chapter 34, Mineral Resources of the Western Canada Sedimentary Basin
162 MB	Chapter 35, Automated Data Processing for the Geological Atlas of the Western Canada Sedimentary Basin

Conferences Involving Alberta Geological Survey

Alberta Association of Municipal Districts and Counties (AAMDC)
March 15 to 17, 2010
Shaw Conference Centre
Edmonton, Alberta

Calgary Mining Forum
Mineral Exploration Group
April 20 to 23, 2010
Ramada Hotel Downtown
Calgary, Alberta

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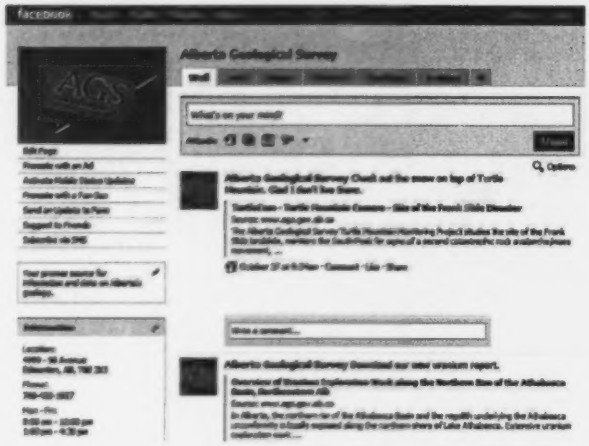

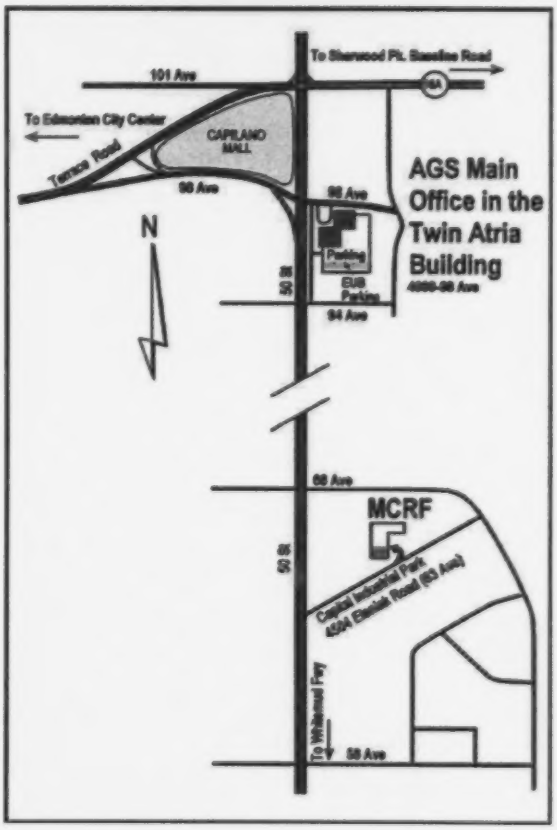

AGS Locations

The main office of the Alberta Geological Survey is located at

#402, 4999 - 98th Avenue
Edmonton, Alberta
Canada T6B 2X3
Tel: (780) 422-1927
www.ags.gov.ab.ca

The Alberta Geological Survey Information Centre is located at the address above and may be contacted at
Tel: (780) 422-1927
E-mail: AGS-Info@ercb.ca

Our Mineral Core Research Facility (MCRF) is located at
4504 Eleniak Road
Edmonton, Alberta

For information on the MCRF or to book a visit, contact Rob Natyshen by phone at (780) 466-1779 or by e-mail at Rob.Natyshen@ercb.ca